

This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found [here](#).

If you have a suggestion to make the keys better, please fill out the short survey [here](#).

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

1. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 13 \div 17 * 20 - (14 * 8)$$

The solution is -126.294 , which is option B.

- A. $[-228.35, -218.35]$

-226.353 , which corresponds to not distributing a negative correctly.

- B. $[-131.29, -122.29]$

-126.294 , which is the correct option.

- C. $[-111.04, -105.04]$

-111.038 , which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

- D. $[112.96, 115.96]$

112.962 , which corresponds to not distributing addition and subtraction correctly.

- E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{19044}{36}}$$

The solution is Whole, which is option A.

- A. Whole

* This is the correct option!

- B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

- C. Irrational

These cannot be written as a fraction of Integers.

- D. Integer

These are the negative and positive counting numbers (... , -3, -2, -1, 0, 1, 2, 3, ...)

E. Rational

These are numbers that can be written as fraction of Integers (e.g., $-2/3$)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 138.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{28900}{289}}$$

The solution is Integer, which is option A.

A. Integer

* This is the correct option!

B. Rational

These are numbers that can be written as fraction of Integers (e.g., $-2/3$)

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -170 .

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-20}{-12} + 64i^2$$

The solution is Rational, which is option D.

A. Pure Imaginary

This is a Complex number ($a + bi$) that **only** has an imaginary part like $2i$.

B. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

C. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

D. Rational

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(10 + 2i)(4 + 3i)$$

The solution is $34 + 38i$, which is option B.

- A. $a \in [42, 50]$ and $b \in [16, 26]$

$46 + 22i$, which corresponds to adding a minus sign in the first term.

- B. $a \in [30, 37]$ and $b \in [35, 43]$

* $34 + 38i$, which is the correct option.

- C. $a \in [30, 37]$ and $b \in [-43, -36]$

$34 - 38i$, which corresponds to adding a minus sign in both terms.

- D. $a \in [39, 44]$ and $b \in [5, 7]$

$40 + 6i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

- E. $a \in [42, 50]$ and $b \in [-23, -19]$

$46 - 22i$, which corresponds to adding a minus sign in the second term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{63 - 33i}{4 - 5i}$$

The solution is $10.17 + 4.46i$, which is option C.

- A. $a \in [416, 417.5]$ and $b \in [3.5, 5.5]$

$417.00 + 4.46i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

- B. $a \in [9.5, 10.5]$ and $b \in [181.5, 184]$

$10.17 + 183.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [9.5, 10.5]$ and $b \in [3.5, 5.5]$

* $10.17 + 4.46i$, which is the correct option.

D. $a \in [1, 4]$ and $b \in [-11.5, -10.5]$

$2.12 - 10.90i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [14.5, 16.5]$ and $b \in [5.5, 7.5]$

$15.75 + 6.60i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-9 - 4i)(-6 + 2i)$$

The solution is $62 + 6i$, which is option D.

A. $a \in [52, 58]$ and $b \in [-9.4, -7.8]$

$54 - 8i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [46, 50]$ and $b \in [40.42, 42.03]$

$46 + 42i$, which corresponds to adding a minus sign in the second term.

C. $a \in [59, 64]$ and $b \in [-6.19, -5.59]$

$62 - 6i$, which corresponds to adding a minus sign in both terms.

D. $a \in [59, 64]$ and $b \in [4.87, 7.82]$

* $62 + 6i$, which is the correct option.

E. $a \in [46, 50]$ and $b \in [-42.35, -41.86]$

$46 - 42i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-18 + 77i}{6 - 3i}$$

The solution is $-7.53 + 9.07i$, which is option C.

A. $a \in [-339.5, -338]$ and $b \in [8.5, 10.5]$

$-339.00 + 9.07i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-4, -2]$ and $b \in [-26.5, -25]$

$-3.00 - 25.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-9, -6]$ and $b \in [8.5, 10.5]$

* $-7.53 + 9.07i$, which is the correct option.

D. $a \in [2, 3]$ and $b \in [11, 12]$

$2.73 + 11.47i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-9, -6]$ and $b \in [407.5, 409]$

$-7.53 + 408.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

9. Simplify the expression below and choose the interval the simplification is contained within.

$$20 - 2 \div 6 * 12 - (11 * 4)$$

The solution is -28.000 , which is option D.

A. $[-27.1, -23.8]$

-24.028 , which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[19, 21.7]$

20.000 , which corresponds to not distributing a negative correctly.

C. $[61.4, 65.5]$

63.972 , which corresponds to not distributing addition and subtraction correctly.

D. $[-28.6, -25.1]$

* -28.000 , which is the correct option.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

10. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{450}{5}} + \sqrt{132}i$$

The solution is Nonreal Complex, which is option D.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Rational

These are numbers that can be written as fraction of Integers (e.g., $-2/3 + 5$)

C. Pure Imaginary

This is a Complex number ($a + bi$) that **only** has an imaginary part like $2i$.

D. Nonreal Complex

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

11. Simplify the expression below and choose the interval the simplification is contained within.

$$8 - 6 \div 16 * 12 - (18 * 2)$$

The solution is -32.500 , which is option C.

A. $[-30.3, -28.4]$

-29.000 , which corresponds to not distributing a negative correctly.

B. $[43.6, 44.1]$

43.969 , which corresponds to not distributing addition and subtraction correctly.

C. $[-32.9, -30]$

* -32.500 , which is the correct option.

D. $[-28.5, -25.6]$

-28.031 , which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

12. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{24}{0}}$$

The solution is Not a Real number, which is option B.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Not a Real number

* This is the correct option!

C. Integer

These are the negative and positive counting numbers (... , -3, -2, -1, 0, 1, 2, 3, ...)

D. Irrational

These cannot be written as a fraction of Integers.

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{\frac{24}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

13. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{-1716}{13}}$$

The solution is Not a Real number, which is option C.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Integer

These are the negative and positive counting numbers (... , -3, -2, -1, 0, 1, 2, 3, ...)

C. Not a Real number

* This is the correct option!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{132}i$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

14. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-1568}{14}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option B.

A. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

B. Pure Imaginary

* This is the correct option!

C. Rational

These are numbers that can be written as fraction of Integers (e.g., $-2/3 + 5$)

D. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

15. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(8 - 6i)(-7 - 5i)$$

The solution is $-86 + 2i$, which is option E.

A. $a \in [-28, -18]$ and $b \in [81, 84]$

$-26 + 82i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-87, -83]$ and $b \in [-4, 0]$

$-86 - 2i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-56, -53]$ and $b \in [29, 33]$

$-56 + 30i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

D. $a \in [-28, -18]$ and $b \in [-85, -80]$

$-26 - 82i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-87, -83]$ and $b \in [0, 5]$

* $-86 + 2i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

16. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-45 - 11i}{3 - 4i}$$

The solution is $-3.64 - 8.52i$, which is option A.

A. $a \in [-5.5, -3.5]$ and $b \in [-9.5, -8]$

* $-3.64 - 8.52i$, which is the correct option.

B. $a \in [-8, -6.5]$ and $b \in [5.5, 6.5]$

$-7.16 + 5.88i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-17, -14]$ and $b \in [1, 4]$

$-15.00 + 2.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-5.5, -3.5]$ and $b \in [-213.5, -212.5]$

$-3.64 - 213.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-91.5, -90]$ and $b \in [-9.5, -8]$

$-91.00 - 8.52i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

17. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-6 + 2i)(-10 + 4i)$$

The solution is $52 - 44i$, which is option E.

A. $a \in [58, 62]$ and $b \in [6, 15]$

$60 + 8i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [66, 71]$ and $b \in [0, 5]$

$68 + 4i$, which corresponds to adding a minus sign in the second term.

C. $a \in [45, 55]$ and $b \in [37, 45]$

$52 + 44i$, which corresponds to adding a minus sign in both terms.

D. $a \in [66, 71]$ and $b \in [-7, -1]$

$68 - 4i$, which corresponds to adding a minus sign in the first term.

E. $a \in [45, 55]$ and $b \in [-45, -43]$

* $52 - 44i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

18. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-36 - 11i}{6 - 2i}$$

The solution is $-4.85 - 3.45i$, which is option B.

A. $a \in [-5.99, -5.93]$ and $b \in [-1, 1]$

$-5.95 + 0.15i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-4.87, -4.85]$ and $b \in [-4.5, -3]$

* $-4.85 - 3.45i$, which is the correct option.

C. $a \in [-6.01, -5.96]$ and $b \in [4, 6]$

$-6.00 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-4.87, -4.85]$ and $b \in [-138.5, -137.5]$

$-4.85 - 138.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-194.02, -193.99]$ and $b \in [-4.5, -3]$

$-194.00 - 3.45i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

19. Simplify the expression below and choose the interval the simplification is contained within.

$$17 - 8 \div 15 * 9 - (13 * 5)$$

The solution is -52.800 , which is option A.

A. $[-54.8, -50.8]$

* -52.800 , which is the correct option.

B. $[-50.06, -44.06]$

-48.059 , which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[76.94, 82.94]$

81.941 , which corresponds to not distributing addition and subtraction correctly.

D. $[-8, -0]$

-4.000 , which corresponds to not distributing a negative correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

20. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{49}} + \sqrt{5}i$$

The solution is Pure Imaginary, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., $-2/3 + 5$)

B. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

C. Pure Imaginary

* This is the correct option!

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

21. Simplify the expression below and choose the interval the simplification is contained within.

$$5 - 6 \div 16 * 19 - (4 * 18)$$

The solution is -74.125 , which is option C.

A. $[-114.25, -107.25]$

-110.250 , which corresponds to not distributing a negative correctly.

B. $[76.98, 80.98]$

76.980 , which corresponds to not distributing addition and subtraction correctly.

C. $[-78.12, -69.12]$

* -74.125 , which is the correct option.

D. $[-69.02, -64.02]$

-67.020 , which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

22. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{144}{49}}$$

The solution is Rational, which is option D.

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

D. Rational

* This is the correct option!

E. Integer

These are the negative and positive counting numbers (... , -3, -2, -1, 0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{12}{7}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

23. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{840}{14}}$$

The solution is Irrational, which is option B.

A. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

B. Irrational

* This is the correct option!

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Integer

These are the negative and positive counting numbers (... , -3, -2, -1, 0, 1, 2, 3, ...)

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{60}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

24. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{143}}{6} + \sqrt{-4}i$$

The solution is Irrational, which is option B.

- A. Rational

These are numbers that can be written as fraction of Integers (e.g., $-2/3 + 5$)

- B. Irrational

* This is the correct option!

- C. Pure Imaginary

This is a Complex number ($a + bi$) that **only** has an imaginary part like $2i$.

- D. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

- E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

25. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(7 + 3i)(-4 + 2i)$$

The solution is $-34 + 2i$, which is option A.

- A. $a \in [-35, -33.3]$ and $b \in [0.3, 2.6]$

* $-34 + 2i$, which is the correct option.

- B. $a \in [-35, -33.3]$ and $b \in [-2.4, 1.6]$

$-34 - 2i$, which corresponds to adding a minus sign in both terms.

- C. $a \in [-24.9, -18.6]$ and $b \in [-26.5, -22.1]$

$-22 - 26i$, which corresponds to adding a minus sign in the second term.

- D. $a \in [-32, -27.2]$ and $b \in [5.6, 8.2]$

$-28 + 6i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

- E. $a \in [-24.9, -18.6]$ and $b \in [24.6, 26.8]$

$-22 + 26i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

26. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{27 - 44i}{-5 + 8i}$$

The solution is $-5.47 + 0.04i$, which is option E.

- A. $a \in [-487.16, -486.97]$ and $b \in [0, 0.7]$

$-487.00 + 0.04i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

- B. $a \in [2.33, 2.62]$ and $b \in [4.55, 5.45]$

$2.44 + 4.90i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

- C. $a \in [-5.45, -5.34]$ and $b \in [-5.55, -5.15]$

$-5.40 - 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

- D. $a \in [-5.51, -5.42]$ and $b \in [3.95, 4.45]$

$-5.47 + 4.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

- E. $a \in [-5.51, -5.42]$ and $b \in [0, 0.7]$

* $-5.47 + 0.04i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

27. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-3 + 8i)(2 - 6i)$$

The solution is $42 + 34i$, which is option C.

- A. $a \in [-7, -2]$ and $b \in [-48.7, -45.3]$

$-6 - 48i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

- B. $a \in [-57, -50]$ and $b \in [-2.8, -1.7]$

$-54 - 2i$, which corresponds to adding a minus sign in the second term.

- C. $a \in [33, 47]$ and $b \in [31.5, 36.6]$

* $42 + 34i$, which is the correct option.

- D. $a \in [-57, -50]$ and $b \in [-0.9, 2.4]$

$-54 + 2i$, which corresponds to adding a minus sign in the first term.

- E. $a \in [33, 47]$ and $b \in [-35.5, -30.9]$

$42 - 34i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

28. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{9 + 66i}{-8 - 3i}$$

The solution is $-3.70 - 6.86i$, which is option D.

- A. $a \in [-270.5, -269]$ and $b \in [-7, -5.9]$

$-270.00 - 6.86i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

- B. $a \in [1.5, 3]$ and $b \in [-7.7, -7.25]$

$1.73 - 7.60i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

- C. $a \in [-4.5, -3]$ and $b \in [-501.35, -500.4]$

$-3.70 - 501.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

- D. $a \in [-4.5, -3]$ and $b \in [-7, -5.9]$

$-3.70 - 6.86i$, which is the correct option.

- E. $a \in [-2.5, 0]$ and $b \in [-22.35, -21.45]$

$-1.12 - 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

29. Simplify the expression below and choose the interval the simplification is contained within.

$$18 - 16^2 + 2 \div 8 * 14 \div 20$$

The solution is -237.825 , which is option C.

- A. $[-238.04, -237.96]$

-237.999 , which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

- B. $[273.92, 274.05]$

274.001 , which corresponds to two Order of Operations errors.

- C. $[-237.85, -237.78]$

-237.825 , this is the correct option

- D. $[274.15, 274.18]$

274.175 , which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

- E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

30. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-490}{0}}i + \sqrt{176}i$$

The solution is Not a Complex Number, which is option C.

- A. Pure Imaginary

This is a Complex number ($a + bi$) that **only** has an imaginary part like $2i$.

- B. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

- C. Not a Complex Number

* This is the correct option!

- D. Rational

These are numbers that can be written as fraction of Integers (e.g., $-2/3 + 5$)

- E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.
